

## REMARKS

This is a Preliminary Amendment filed with a Request for Continued Examination (RCE). This is a full response to the final Office Action of February 23, 2007 and the Advisory Action of May 11, 2007. Reconsideration and allowance of the application and all presently pending claims are respectfully requested.

Upon entry of this Response, claims 1-9 are pending in this application. Claims 1, 5, and 7 have been amended. Claims 10-16 have been withdrawn by the Examiner. The prior art made of record has been considered, but is not believed to affect the patentability of the presently pending claims. Applicants believe that no new matter has been added by the amendments and that a new search is not necessary.

## CLAIMS

### Claim 1

Claim 1 is rejected under 35 U.S.C. §103(a) as purportedly being anticipated by Crawford. (U.S. Patent 6,936,212) in view of Jang (U.S. Patent 6,401,002). Amended claim 1 reads as follows:

A method of producing a three-dimensional object, comprising the steps of:  
(a) providing criteria about the three-dimensional object, the three-dimensional object is divided into complete layers and partial layers, the criteria indicate that after a specified number of complete layers are formed a partial layer is formed, the partial layer includes a shell layer and does not include an interior layer, and the complete layer includes the shell layer and the interior layer, **wherein the shell layer forms only an exterior layer of the three-dimensional object and the interior layer forms only a layer within the three-dimensional object**;  
(b) forming a base layer, the base layer includes a shell layer and does not include an interior layer;  
(c) planing the base layer;  
(d) forming a complete layer according to the criteria;  
(e) planing the complete layer;  
(f) forming a partial layer according to the criteria;  
(g) planing the partial layer; and  
(h) repeating steps (d) through (g) until the three dimensional object is formed, **wherein the interior layer forms a solid layer within the shell layer.**

(Emphasis added). Applicants traverse each of the §103 rejections in the Office Action and submit that the rejection of claim 1 under 35 U.S.C. §103 in view of cited references should be withdrawn because the cited references, individually or in combination, do not disclose, teach, or suggest each and every feature of claim 1 above. In this regard, Crawford does not disclose, teach, or suggest that “the shell layer forms only an exterior layer of the three-dimensional object and the interior layer forms only a layer within the three-dimensional object ...the interior layer forms a solid layer within the shell layer” as recited in claim 1.

In order for a claim to be properly rejected under 35 U.S.C. §103, the teachings of the cited art reference must suggest all features of the claimed invention to one of ordinary skill in the art. See, e.g., *In re Dow Chemical*, 837 F.2d 469, 5 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1988); *In re Keller*, 642 F.2d 413, 208 U.S.P.Q. 871, 881 (C.C.P.A. 1981). Further, “[t]he PTO has the burden under section 103 to establish a prima facie case of obviousness. It can satisfy this burden only by showing some objective teaching in the cited art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references.” *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

When applying 35 U.S.C. 103, the following tenets of patent law must be adhered to:

- (A) The claimed invention must be considered as a whole;
- (B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination;
- (C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention and
- (D) Reasonable expectation of success is the standard with which obviousness is determined.

*Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986).

In order to establish the *prima facie* case of obviousness, the Examiner must establish a suggestion or motivation either in the references themselves, or in the knowledge generally available to one of ordinary skill in the art to modify the reference or

combine reference teachings in order to result in the claimed invention. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

In this regard, Applicants note that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest **both** the combination of elements **and** the structure resulting from the combination. *Stiftung v. Renishaw PLC*, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of these two prior art references, the prior art must properly suggest the desirability in the references themselves for combining the particular elements.

As has been acknowledged by the Court of Appeals for the Federal Circuit, the U.S. Patent and Trademark Office ("USPTO") has the burden under section 103 to establish a *prima facie* case of obviousness by showing some objective teaching in the prior art or generally available knowledge of one of ordinary skill in the art that would lead that individual to the claimed invention. *See In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). The Manual of Patent Examining Procedure (MPEP) section 2143 discusses the requirements of a *prima facie* case for obviousness. That section provides as follows:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teaching. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure.

As described in detail below, the Office has not satisfied its *prima facie* case. In particular, the Office submits that combining Crawford with Jang cures the deficiencies of Crawford alone. However, one skilled in the art would not combine Crawford and Jang because the combination is counter to the teachings of Crawford and such a combination would defeat the purposes of the invention as taught in Crawford. In particular, Crawford teaches that the internal lattice structure maintains the geometric tolerances during the

fabrication process to prevent non-uniform deforming (Col. 3, lines 34-37 and 60-63). In addition, an object of the invention is that the use of the internal lattice structure will reduce the costs of manufacturing by reducing the amount of build material needed while also being able to increase the speed of prototyping (Col. 4, lines 11-18). Crawford specifically teaches away from combining the solid layer taught in Jung by stating that the internal lattice can reduce non-linear shrinkage and that non-linear shrinkage can not be compensated for when forming solid objects (which is what is taught in Jang and suggested by the Office) (Col. 6, lines 4-27). Crawford provides ample evidence that one skilled in the art would not combine Crawford with Jang.

The Office must consider the cited references as a whole and the combination of the teachings of the references should have a reasonable expectation of success. In this regard, one skilled in the art, considering the references as a whole, would not combine the teachings of Crawford with the teachings of Jang since the teachings of Jang would destroy the purpose and use of what is taught in Crawford. In this regard, the teachings of Jang teach away from the teachings of Crawford. As a result, the cited references do not describe the desirability to combine the references, but rather teach reasons why not to combine the references and one skilled in the art would not have a reasonable expectation of success. Thus, for at least this reason the rejection of claim 1 should be withdrawn.

In addition, the Office Action has not articulated reasoning with some rational underpinning to support the conclusion of obviousness. The Office Action does not provide any explanation regarding the clear inconsistent teachings between Crawford and Jang. The Office Action only makes a general statement that one of skill in the art would combine the references. The Office Action must articulate reasoning with some rational underpinning to support the conclusion of obviousness. Since the Office Action does not provide such reasoning, the Office has not satisfied its prima facie case. Thus, for at least this reason the rejection of claim 1 should be withdrawn.

## **Claims 2-4**

Applicants respectfully submit that pending dependent claims 2-4 include every feature of independent claim 1. Thus, pending dependent claims 2-4 are also allowable. In re Fine, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Notwithstanding the arguments made above in reference to claim 1, the cited references do not teach “monitoring waste produced for each planing; and modifying the criteria if the waste produced is above a waste threshold” as recited in claim 2. The Office Action states that Crawford and Jang do not teach the features noted above as recited in claim 2. The Office Action asserts that Kerekes (U.S. Patent 6,492,651) teaches the features of claim 2. However, the Office Action has not pointed out anywhere in Kerekes that teaches “monitoring waste...” as recited in claim 2. The Office Action again states that monitoring of height constitutes waste monitoring. Monitoring waste has nothing to do with monitoring height. Waste is collected and monitored as each layer is planned. Monitoring waste is used to adjust the criteria for forming layers. For example, if the waste exceeds a waste threshold, the system forms a partial layer. Height monitoring is not a consideration and is unrelated to waste monitoring. In particular, height monitoring pertains to monitoring the height. The Office Action notes that Kerekes teaches monitoring height, which confirms that height monitoring pertains to monitoring height. However, monitoring height does not constitute monitoring waste. Also, the Office Action notes that “the end result is the same as the instant process, it would have been prima facie obvious to one of ordinary skill that the methods were equivalent”. However, the Office Action has not articulated reasoning with some rational underpinning to support the conclusion of obviousness. The Office Action only makes a general statement that one of skill in the art would combine the references. The Office Action must articulate reasoning with some rational underpinning to support the conclusion of obviousness. Since the Office Action does not provide such

reasoning, the Office has not satisfied its prima facie case. Therefore, the rejection of claim 2 should be withdrawn.

#### Claim 5

Claim 5 is rejected under 35 U.S.C. §103(a) as purportedly being anticipated by Crawford. (U.S. Patent 6,936,212) in view of Jang (U.S. Patent 6,401,002) and Kerekes (U.S. Patent 6,492,651). Amended claim 5 reads as follows:

A method of producing a three-dimensional object, comprising the steps of:  
providing criteria about the three-dimensional object, the three-dimensional object is divided into layers, the layers include a shell layer and an interior layer, ***the shell layer forms only an exterior layer of the three-dimensional object and the interior layer forms only a layer within the three-dimensional object***, the shell layer includes at least one shell voxel, the interior layer includes at least one interior voxel, the criteria indicate selected interior voxels of the at least one interior voxels to form for each layer, the criteria indicate a sequence in which to form each layer, and the selected interior voxels for each layer in the sequence include a different combination of interior voxels;  
forming a plurality of layers according to the criteria;  
planing at least one layer, wherein ***the interior layer forms a solid layer within the shell layer***, and  
forming the three-dimensional object.

(Emphasis added). Applicants traverse each of the §103 rejections in the Office Action and submit that the rejection of claim 5 under 35 U.S.C. §103 in view of cited references should be withdrawn because the cited references, individually or in combination, do not disclose, teach, or suggest each and every feature of claim 5 above. In this regard, Crawford does not disclose, teach, or suggest that “the layers include a shell layer and an interior layer, the shell layer forms only an exterior layer of the three-dimensional object and the interior layer forms only a layer within the three-dimensional object, the shell layer includes at least one shell voxel, the interior layer includes at least one interior voxel, the criteria indicate selected interior voxels of the at least one interior voxels to form for each layer, the criteria indicate a sequence in which to form each layer, and the selected interior voxels for each layer in the sequence include a different combination of interior voxels...the interior layer forms a solid layer within the shell layer” as recited in claim 5.

In regard to Kerekes, the Office Action states that because of the dimensional variability, and because the methods are directed to detect and fill in low spots, "it is evident that different combinations of interior voxels will be applied to each layer". The Office Action notes that Kerekes teaches that such variability are the result of numerous phenomena, "such as accumulated effects of drop volume variation, thermal distortion, errors in deposition, and the like" (Col. 1, lines 51-54). Thus, it appears that the Office is suggesting that Kerekes teaches that the variability in height is accommodated by filling in low spots. It should be noted that Kerekes teaches that such variability is a common problem associated with layer-by-layer building. The method of Kerekes does not intentionally form such low spots and attempts to accommodate such problems. In contrast, the features of claim 5 include selectively forming the layers by forming each layer with a different combination of interior voxels, thereby intentionally forming low spots to provide a smaller surface area to be milled during the milling process. The method of Kerekes does not intend to form the low spots, but rather the low spots are formed by the numerous phenomena mentioned above. Thus, Applicants submit that from the teachings of Kerekes it is not evident that different combinations of interior voxels will be applied to each layer. Furthermore, the Office Action must articulate reasoning with some rational underpinning to support the conclusion of obviousness. The general statement that it is "evident" does not satisfy an articulation of reasoning with some rational underpinning to support the conclusion of obviousness. Therefore, the rejection of claim 5 should be withdrawn.

In addition, the Office submits that combining Crawford with Jang cures the deficiencies of Crawford alone. However, one skilled in the art would not combine Crawford and Jang because the combination is counter to the teachings of Crawford and such a combination would defeat the purposes of the invention as taught in Crawford. In particular, Crawford teaches that the internal lattice structure maintains the geometric tolerances during the fabrication process to prevent non-uniform deforming (Col. 3, lines 34-37 and 60-63). In addition, an object of the invention is that the use of the internal lattice structure will reduce the

costs of manufacturing by reducing the amount of build material needed while also being able to increase the speed of prototyping (Col. 4, lines 11-18). Crawford specifically teaches away from combining the solid layer taught in Jung by stating that the internal lattice can reduce non-linear shrinkage and that non-linear shrinkage can not be compensated for when forming solid objects (which is what is taught in Jang and suggested by the Office) (Col. 6, lines 4-27). Crawford provides ample evidence that one skilled in the art would not combine Crawford with Jang.

The Office must consider the cited references as a whole and the combination of the teachings of the references should have a reasonable expectation of success. In this regard, one skilled in the art, considering the references as a whole, would not combine the teachings of Crawford with the teachings of Jang since the teachings of Jang would destroy the purpose and use of what is taught in Crawford. In this regard, the teachings of Jang teach away from the teachings of Crawford. As a result, the cited references do not describe the desirability to combine the references, but rather teach reasons why not to combine the references and one skilled in the art would not have a reasonable expectation of success. Thus, for at least this reason the rejection of claim 5 should be withdrawn. In addition, the Office Action has not articulated reasoning with some rational underpinning to support the conclusion of obviousness. The Office Action does not provide any explanation regarding the clear inconsistent teachings between Crawford and Jang. The Office Action only makes a general statement that one of skill in the art would combine the references. The Office Action must articulate reasoning with some rational underpinning to support the conclusion of obviousness. Since the Office Action does not provide such reasoning, the Office has not satisfied its prima facie case. Thus, for at least this reason the rejection of claim 5 should be withdrawn.



## Claims 6 and 17

Applicants respectfully submit that pending dependent claims 6 and 17 include every feature of independent claim 5. Thus, pending dependent claims 6 and 17 are also allowable. In re Fine.

## Claim 7

Claim 7 is rejected under 35 U.S.C. §103(a) as purportedly being anticipated by Crawford. (U.S. Patent 6,936,212) in view of Jang (U.S. Patent 6,401,002) and Kerekes (U.S. Patent 6,492,651). Amended claim 7 reads as follows:

A method of producing a three-dimensional object, comprising the steps of:  
providing a criteria for forming the three-dimensional object, the three-dimensional object includes a plurality of layers, each layer includes layers selected from a shell layer and an interior layer, ***the shell layer forms only an exterior layer of the three-dimensional object and the interior layer forms only a layer within the three-dimensional object***, the shell layer includes at least one shell voxel, and the interior layer includes at least one interior voxel;  
forming and planing the layers in an iterative manner using the criteria provided, wherein ***the interior layer forms a solid layer within the shell layer***,  
***monitoring waste produced for each planing;***  
***modifying the criteria if the waste produced is above a waste threshold;***  
controlling an amount of waste produced by using the criteria provided; and  
forming the three-dimensional object.

(Emphasis added). Applicants traverse each of the §103 rejections in the Office Action and submit that the rejection of claim 7 under 35 U.S.C. §103 in view of cited references should be withdrawn because the cited references, individually or in combination, do not disclose, teach, or suggest each and every feature of claim 7 above. In this regard, Crawford does not disclose, teach, or suggest that “the shell layer forms only an exterior layer of the three-dimensional object and the interior layer forms only a layer within the three-dimensional object ...the interior layer forms a solid layer within the shell layer...monitoring waste produced for each planing; modifying the criteria if the waste produced is above a waste threshold” as recited in claim 7.

As described in detail below, the Office has not satisfied its prima facie case. In particular, the Office submits that combining Crawford with Jang cures the deficiencies of Crawford alone. However, one skilled in the art would not combine Crawford and Jang because the combination is counter to the teachings of Crawford and such a combination would defeat the purposes of the invention as taught in Crawford. In particular, Crawford teaches that the internal lattice structure maintains the geometric tolerances during the fabrication process to prevent non-uniform deforming (Col. 3, lines 34-37 and 60-63). In addition, an object of the invention is that the use of the internal lattice structure will reduce the costs of manufacturing by reducing the amount of build material needed while also being able to increase the speed of prototyping (Col. 4, lines 11-18). Crawford specifically teaches away from combining the solid layer taught in Jung by stating that the internal lattice can reduce non-linear shrinkage and that non-linear shrinkage can not be compensated for when forming solid objects (which is what is taught in Jang and suggested by the Office) (Col. 6, lines 4-27). Crawford provides ample evidence that one skilled in the art would not combine Crawford with Jang.

The Office must consider the cited references as a whole and the combination of the teachings of the references should have a reasonable expectation of success. In this regard, one skilled in the art, considering the references as a whole, would not combine the teachings of Crawford with the teachings of Jang since the teachings of Jang would destroy the purpose and use of what is taught in Crawford. In this regard, the teachings of Jang teach away from the teachings of Crawford. As a result, the cited references do not describe the desirability to combine the references, but rather teach reasons why not to combine the references and one skilled in the art would not have a reasonable expectation of success. Thus, for at least this reason the rejection of claim 7 should be withdrawn. In addition, the Office Action has not articulated reasoning with some rational underpinning to support the conclusion of obviousness. The Office Action does not provide any explanation regarding the clear inconsistent teachings between Crawford and Jang. The

Office Action only makes a general statement that one of skill in the art would combine the references. The Office Action must articulate reasoning with some rational underpinning to support the conclusion of obviousness. Since the Office Action does not provide such reasoning, the Office has not satisfied its prima facie case. Thus, for at least this reason the rejection of claim 7 should be withdrawn.

The Office Action states that Crawford and Jang do not teach the features noted above as recited in claim 7. The Office Action asserts that Kerekes (U.S. Patent 6,492,651) teaches the features of claim 7. However, the Office Action has not pointed out anywhere in Kerekes that teaches "monitoring waste..." as recited in claim 7. The Office Action again states that monitoring of height constitutes waste monitoring. Monitoring waste has nothing to do with monitoring height. Waste is collected and monitored as each layer is planned. Monitoring waste is used to adjust the criteria for forming layers. For example, if the waste exceeds a waste threshold, the system forms a partial layer. Height monitoring is not a consideration and is unrelated to waste monitoring. In particular, height monitoring pertains to monitoring the height. The Office Action notes that Kerekes teaches monitoring height, which confirms that height monitoring pertains to monitoring height. However, monitoring height does not constitute monitoring waste. Also, the Office Action notes that "the end result is the same as the instant process, it would have been prima facie obvious to one of ordinary skill that the methods were equivalent". However, the Office Action has not articulated reasoning with some rational underpinning to support the conclusion of obviousness. The Office Action only makes a general statement that one of skill in the art would combine the references. The Office Action must articulate reasoning with some rational underpinning to support the conclusion of obviousness. Since the Office Action does not provide such reasoning, the Office has not satisfied its prima facie case. Therefore, the rejection of claim 7 should be withdrawn.

### **Claims 8 and 9**

Applicants respectfully submit that pending dependent claims 8 and 9 include every feature of independent claim 7. Thus, pending dependent claims 8 and 9 are also allowable.

In re Fine.

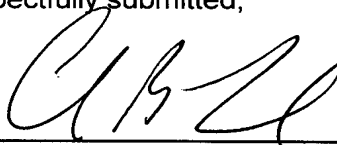
## **CONCLUSION**

In light of the foregoing amendments and for at least the reasons set forth above, Applicants respectfully submit that all objections and/or rejections have been traversed, rendered moot, and/or accommodated. Favorable reconsideration and allowance of the present application and all pending claims are hereby courteously requested.

In addition, any other statements in the Office Action that are not explicitly addressed herein are not intended to be admitted. In addition, any and all findings of inherency are traversed as not having been shown to be necessarily present. Furthermore, any and all findings of well-known art and official notice, or statements interpreted similarly, should not be considered well known since the Office Action does not include specific factual findings predicated on sound technical and scientific reasoning to support such conclusions.

If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (770) 933-9500.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'CBL', is written over a horizontal line.

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## CERTIFICATE OF MAILING

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on 6/15/07

Sara Rogers  
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In Re Application of:

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Examiner: Lawrence Emile Lambelet

Docket No. HP: 200309747-1  
TKHR: 050834-1220

For: **SYSTEMS AND METHODS FOR REDUCING WASTE IN SOLID FREEFORM  
FABRICATION**

The following is a list of documents enclosed:

Return Postcard  
Response  
RCE Transmittal Sheet  
Petition for Extension of Time